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3M

October 26, 2004

8EHQ-1004-15930

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Office of Pollution, Prevention and Toxics
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N. W.
Washington, DC 20460
Attention: Section 8(e) Coordinator

Re: **TSCA Section 8(e) Submissions**

Dear Sir/Madam:

3M Company ("3M") requests that EPA place the attached studies in the TSCA Section 8(e) docket. We have included a master index for these studies identifying the study title, test substance and CAS number. A Confidential Business Information (CBI) version of this index and the studies also is being submitted today pursuant to EPA procedures. 3M has not provided CBI substantiation with this submission, but would be willing to do so at the Agency's request.

3M has concluded that data in these studies may not be, strictly speaking, "corroborative" of previously reported or published information as defined in EPA's reporting guidance or otherwise potentially may warrant 8(e) submission based on EPA's reporting guidance.

3M appreciates EPA's attention to this matter. Please contact the undersigned if you have any questions or require further information regarding this submission.

Very truly yours,

8EHQ-05-15930

Katherine E. Reed (9.7.)

Dr. Katherine E. Reed, Ph.D
Staff Vice President
Environmental Technology and Safety Services
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Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
(Confidential Business Information Redacted)

Title	Substance Information	CAS Information
Aquatic Toxicity Data Sheet: 48hr *Daphnia Magna*	1,4-dioxane; heptadecafluoro-1-octanesulfonic acid; linear n-ethyl perfluorooctanesulfonamide; n-ethylperfluorooctanesulfonamidoethyl alcohol; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; polyethylene glycol; water	1,4-dioxane (123-91-1); heptadecafluoro-1-octanesulfonic acid (1763-23-1); linear n-ethyl perfluorooctanesulfonamide (4151-50-2); n-ethylperfluorooctanesulfonamidoethyl alcohol (1691-99-2); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (29117-08-6); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-79-3); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-81-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (56372-23-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-80-6); polyethylene glycol (25322-68-3); water (7732-18-5)
Multigeneration Daphnid Life Cycle Test	1,4-dioxane; heptadecafluoro-1-octanesulfonic acid; linear n-ethyl perfluorooctanesulfonamide; n-ethylperfluorooctanesulfonamidoethyl alcohol; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl]-.omega.-hydroxy-; polyethylene glycol; water	1,4-dioxane (123-91-1); heptadecafluoro-1-octanesulfonic acid (1763-23-1); linear n-ethyl perfluorooctanesulfonamide (4151-50-2); n-ethylperfluorooctanesulfonamidoethyl alcohol (1691-99-2); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(heptadecafluorooctyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (29117-08-6); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(nonafluorobutyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-79-3); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(pentadecafluoroheptyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-81-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(tridecafluorohexyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (56372-23-7); poly(oxy-1,2-ethanediyl), .alpha.-[2-[ethyl[(undecafluoropentyl)sulfonyl]amino]ethyl]-.omega.-hydroxy- (68298-80-6); polyethylene glycol (25322-68-3); water (7732-18-5)
Aquatic Invertebrate Testing - Alkyltins LR 8024-1	Alkyltins: dibutyltin laurate and dibutyltin-di(2 ethylhexoate)	Dibutyltin laurate (CAS 77-58-7); Dibutyltin-di(2 ethylhexoate) (CAS 2781-10-4)
Aquatic Invertebrate Testing - Decosheen Material (LR-8052)	Decosheen Ribbon Materials and pigments: Decosheen Blue in Green Ceres Blue ZV; Decosheen Gold Paste Pigment; Decosheen Royal Blue, Solvent Blue	Decosheen Blue in Green [illegible] Blue ZV (CAS 61814-09-3); Decosheen Royal Blue, Solvent Blue [illegible]-68-6); Decosheen Gold Paste Pigment (CAS Number [illegible]
R Scratch Remover (Fathead Minnow)	55-65% Water; 20-30% Stoddard Solvent; 1-5% Sodium Silicate; 1-5% Potassium Hydroxide; 0.1-3% Nonylphenoxypoly(oxyethylene)ethanol	Water (CAS 7732-18-5); Stoddard Solvent (CAS 8052-41-3); Sodium Silicate (CAS 1344-09-8); Potassium Hydroxide (CAS 1310-58-3); Nonylphenoxypoly(oxyethylene)ethanol (CAS 9016-45-9)
S Scratch Remover (Fathead Minnow)	60-70% Water; 20-30% Stoddard Solvent; 1-5% Sodium Silicate; 0.1-3% Turgitol NP-33	Water (CAS 7732-18-5); Stoddard Solvent (CAS 8052-41-3); Sodium Silicate (CAS 1344-09-8); Turgitol NP-33 (CAS 9016-45-9)
Octanol Water Partition Coefficient	N-methylperfluorooctane sulfonamidoethanol	CAS 24448-09-7

Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
(Confidential Business Information Redacted)

Title	Substance Information	CAS Information
CoCl2.6H2O as Co2+ Toxicity to Microtox Reagent	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1
Activated Sludge Respiration Inhibition Test on CoCl2.6H2O as Co ion	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1
Acute Toxicity of CoCl2.6H20 as Co ion to Daphnia magna under Static Exposure Conditions	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1
Acute Toxicity of CoCl2.6H20 as Co ion to Fathead Minnow under Static Exposure Conditions	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1
Freshwater Algae Growth Inhibition Test	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1
Daphnia magna 21-Day Chronic Reproduction Study	N-ethylperfluorooctane sulfonamidoethanol	CAS 1691-99-2
Plant Growth Effects of [ ]	[ ]	[ ]
Final Report (*Daphnia* and Microtox)	Monomethyl ether of hydroquinone	CAS 150-76-5
Microtox Test Results	2 Ethylhexyl Acrylate; Isooctyl Acrylate Monomer; 2-Methylbutyl acrylate; Methyl isoamyl acrylate; Isooctyl Acrylate	2 Ethylhexyl Acrylate (CAS 103-11-7); Isooctyl Acrylate Monomer (CAS 29590-42-9) 2-Methylbutyl acrylate (CAS 44914-03-6); Methyl isoamyl acrylate (CAS 18993-92-1); Isooctyl Acrylate (CAS 29590-42-9)
Phytotoxicity Test Results	[ ]	[]

Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
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Title	Substance Information	CAS Information
Plant Toxicity Comparison, Young Seedling Growth	[ ]	[ ]
Ceriodaphnia dubia Survival and Reproduction exposed to Opequon Creek Water Spiked with BETZ 1110 Polymer (November 4, 1987 sample) for seven days under static renewal conditions	BETZ 1110: Non-3M Product - Chemical composition not provided to 3M by manufacturer	MSDS provided by manufacturer states product is "not hazardous" and not "considered to be a carcinogen"
Ceriodaphnia dubia Survival and Reproduction exposed to Opequon Creek Water Spiked with Betz 1138 Polymer (November 4, 1987 sample) for seven days under static renewal conditions	BETZ 1138: Non-3M Product - Chemical composition not provided to 3M by manufacturer	MSDS provided by manufacturer states product is "not hazardous" and not "considered to be a carcinogen"
Toxicity of 1,6 - Hexanediol Diacrylate to *Daphnia magna*	1,6 Hexanediol diacrylate	CAS 13048-33-4
Daphnia magna Chronic Bioassay Under Static Renewal Conditions	Methyl isoamyl acrylate	CAS 18993-92-1
Estimating the Chronic Toxicity of Nalclear 7177 to *Ceriodaphnia* Survival and Reproduction Using Short-Term Tests	Nalclear 7177 wastewater treatment acrylamide/acrylate polymer - Chemical composition not provided to 3M by manufacturer	CAS Information not provided to 3M by manufacturer
Acute Toxicity of Isooctyl Acrylate to *Daphnia magna*	Isooctyl Acrylate Monomer	CAS 29590-42-9
Static Acute Toxicity of [ ] to the Daphnid, *Daphnia magna*	Tolyltriazole	CAS 29385-43-1
Static Acute Toxicity of [ ] to the Alga, *Selenastrum capricornutum*	Tolyltriazole	CAS 29385-43-1
Static Acute Toxicity of [ ] to the Daphnid, *Daphnia magna*	[ ]	[ ]
Static Acute Toxicity of [ ] to the Fathead Minnow, *Pimephales promelas*	[ ]	[ ]
Static Acute Toxicity of [ ] to the Daphnid, *Daphnia magna*	water; propylene-tetrafluoroethylene polymer; tert-butyl alcohol	water (7732-18-5); propylene-tetrafluoroethylene polymer (27029-05-6); tert-butyl alcohol (75-65-0)

Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
(Confidential Business Information Redacted)

Title	Substance Information	CAS Information
Isooctyl acrylate: Fish, Acute Toxicity Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: *Daphnia sp.* Acute Immobilization Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: Alga, Growth Inhibition Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Isooctyl Acrylate: *Daphnia sp.* Reproduction Test	Isooctyl Acrylate Monomer	CAS 29590-42-9
Acute Toxicity of [ ] to the mysid, *Mysidopsis bahia*	[ ]	[ ]
Final Report (Microtox)	[ ]	[ ]
Determination of the Partition Coefficient (N-Octanol/Water) of T-5896 by High Performance Liquid Chromatography (HPLC)	N-methyl perfluorooctane sulfonamido ethanol; N-methyl perfluorooctane sulfonamidethyl acrylate	N-methyl perfluorooctane sulfonamido ethanol (CAS 25268-77-3); N-methyl perfluorooctane sulfonamidethyl acrylate (CAS 24448-09-7)
OECD Activated Sludge Respiration Inhibition Test Results	N-Dodecyltrimethylammonium chloride	CAS = 112-00-5
Final Report (Fish Acute Toxicity)	Mirataine CB (30% Cocamidopropyl betaine = Amides, coco, N-(3-(dimethylamino)propyl), alkylation products with chloroacetic acid, sodium salts, 70% Water and Inerts); Mirataine COB (30% Coco/Oleamidopropyl Betaine = 1-Propanaminium, 3-amino-N-(carboxymethyl)-N,N-dimethyl-, N-coco acyl derivs., inner salt)	Cocamidopropyl betaine (CAS 70851-07-9); Coco/Oleamidopropyl Betaine (CAS 61789-40-0)
A Flow-Through Life-Cycle Toxicity Test With the Saltwater Mysid (*Mysidopsis bahia*)	Perfluorooctane sulfonate	CAS 1763-23-1
Lithium: Alga, Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
An Early Life-Stage Toxicity Test With the Fathead Minnow (*Pimephales promelas*)	Perfluorooctane sulfonate	CAS 1763-23-1
Lithium: Fish, Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
Lithium: *Daphnia*, Acute toxicity Tests	Lithium Chloride	CAS 7447-41-8
Summary of Toxicity Testing on OSCI and OSF	Octane sulfonyl chloride and Octane sulfonyl fluoride	Octane sulfonyl fluoride (CAS 7795-95-1), Octane sulfonyl chloride (CAS 4063-63-5)
Toxicity to Microtox Test	Lauryldimethylamineoxide	CAS 1643-20-5

Master Index to Studies Submitted Under TSCA 8(e) by 3M Company on October 26, 2004
(Confidential Business Information Redacted)

Title	Substance Information	CAS Information
Ecotoxicological Testing of CoCl2.6H2O as Co2+ ion (Seed Germination and Root Elongation)	Cobalt (as Co2+ ion) (CoCl2.6H2O)	CAS 7791-13-1

TECHNICAL REPORT SUMMARY

Form 6747-11-G

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(Important – If report is printed on both sides of paper, send two copies to P&TCS). Report Summary must be typewritten. Guidelines on reverse side.

Division	Dept. Number
Environmental Laboratory (EE & PC)	0535
Project	**Project Number**
Commercial Chemicals - Light Water Vegetation Studies	9970013000
Report Title	**Report Number**
Plant Growth Effects of FC-600	001
To [redacted]	**Period Covered or Date** 7/30/86
Author(s) [redacted]	**Employee Number(s)** [redacted]
Notebook Reference [redacted]	**No. of Pages Including Coversheet** 16

SECURITY ▶ ☒ Open Report & Summary (Company Confidential) ☐ Closed Report–Open Summary (Special Authorization)

3M CHEMICAL REGISTRY ▶ ☐ Check box if new chemicals are reported. Use Chemical Registry Form 6092 to report all new substances.

KEYWORDS:
Lab Code

Other Keywords

CURRENT OBJECTIVE:
The objective of these studies was to evaluate the effects of [redacted] on emergence and early growth of six plant species and to determine the persistence of residual toxicity to one plant species.

REPORT ABSTRACT: This abstract information is distributed by the Patent & Technical Communications Services to alert 3M'ers to Company R&D. It is Company confidential material.

This report describes phytotoxicity studies conducted on Light Water [redacted] Type V. These bioassays used six terrestrial vascular plant species. Plant seed germination and root elongation were evaluated using the hydroponic, clear pouch technique. Early plant growth effects were evaluated using seedlings potted in soil. These plant growth assays measured inhibition of shoot length and shoot dry weight. In a separate assay, the residual effects of [redacted] on soybean germination and growth was evaluated by a progressive series of plantings on increasingly aged and leached [redacted] treated soil.

[redacted]

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Conclusions

1. [ ]Light Water® ATC/AFFF inhibited plant emergence and early seedling growth at its usage concentration (6% by volume).

2. An order of magnitude dilution below the usage concentration reduced the inhibition of most measured parameters to less than 20%.

3. Furthermore, root elongation was affected at dilutions two orders of magnitude below the usage concentration.

4. Residual effects on early soybean growth from [ ]applied to soil decreased with time and leaching. Aging treated soil for 4 weeks with 3 weekly 2 inch water washings reduced the initial inhibition of plant growth from 100% (complete inhibition) to 20% compared to controls.

Introduction

Standard assays of chemical effects on plants, such as those referenced in this report, typically measure toxicity at the critical early stages of growth, such as plant emergence, seedling growth and development. These assays use a variety of recommended vascular plant species. In this study, effects on plant emergence were assessed by measuring seed germination and root elongation. Early plant growth effects were evaluated by measuring shoot length and shoot dry weight. This study evaluated the phytotoxic effect of [ ]on six indicator plant species: three monocotyledons (grasses) corn, oat, and ryegrass; and three dicotyledons (broad leafs) soybean, cucumber, and tomato. Following the completion of these standard plant bioassay procedures, an additional test using soybean evaluated the persistence of residual effects of [ ]in soil.

Materials and Methods

Experimental Procedures:

The plant growth effects studies were conducted in accordance with OECD Guideline #208 (1). This protocol has been codified as part of the Toxic Substances Control Act Test Guidelines (2,3). This test procedure is also similar to that used by EEC countries (4). The test procedure for evaluating residual effects of [ ]were developed by the 3M Environmental Laboratory.

Test Substance:

The test substance was [ ]Type V, Light Water® Brand ATC/AFFF which was provided by the Industrial Chemical Products Division.

Nutrient Solution Medium:

Half-strength modified Hoagland nutrient solution was used as specified in the referenced procedures.

Plant Species:

This testing utilized six plant species including three monocotyledons: sweet corn (Zea mays), oat (Avena sativa), and perennial ryegrass (Lolium perenne); and three dicotyledons: soybean (Glycine max), cucumber (Cucumis sativus), and tomato (Lycopersicon esculentum).

Test Concentrations:

Concentrations used in testing were 0.06, 0.6, 1.5, 3.0, 6.0% [ ] by vol. The standard usage concentrations for [ ] are 3 and 6%.

Controls:

Blank controls differed only in that they contained no test substance. In these controls equal volumes of water replaced the [ ].

Methods of Chemical Application:

In the early plant growth assays, plants were exposed by two methods: 1) single application to soil (root exposure); and 2) single application to foliage (foliar exposure). In the test for residual effects, solutions contaiing 6% [ ] were applied to soil at various lengths of time prior to seed planting.

Plants exposed through soil received solutions of [ ] in the nutrient solution medium. The volume added to each pot was 50 ml. Each pot contained 5 seedlings and 210±10 g soil (dry weight). The soil was dry enough to hold most of the 50 ml [ ] solution. Pots were placed in glass dishes so that any solution draining from the bottom of the pots was subsequently reabsorbed. Plants exposed through soil application also received a foliar application of 20-25 ml of DI water. Later waterings were through subirrigation so as not to wash the treatment solution from the soil.

Plants exposed by foliar application were sprayed with [ ] solutions in deionized water. The average amount of [ ] deionized water solution that the foliage could hold before dripping to the soil was determined by first misting the controls. The plant foliage was found to hold about 25 ml per pot. This volume of [ ] solution was misted on the plants in all pots of foliar exposed plants. Excess amounts of spray dripped onto the soil. These pots also received 50 ml of the nutrient solution, without the test chemical, applied through subirrigation.

In the residual effects experiment, the planting of 7-8 soybean seeds per pot was delayed for 4, 2, 1, or 0 weeks following application of the 6% [redacted] solution to the soil. The treated pots contained 200 g of soil, and the treatment consisted of applying 1/2 inch of 6% [redacted] (V/V in deionized water) to the soil surface. Treated soil was washed weekly with 2 inches (224 ml) of deionized water starting one week after application of the [redacted] and ending 1 week prior to seed planting. Following planting, the soil was treated with 1/2 inch of standard nutrient solution or, in the case of the 0 week delay plants, with 1/2 inch (56 ml) of a 6% [redacted] - standard nutrient solution. Two weeks following planting, each pot was thinned leaving the 5 most uniform seedlings. After two additional weeks of growth, these 5 remaining seedlings were compared to controls to evaluate growth inhibition in terms of shoot length.

Effects Measured:

The 10-day plant emergence assay measured inhibition of seed germination and root elongation.

The 14-day early plant growth assay measured inhibition of shoot length and inhibition of shoot dry weight (oven-dried at 70°C). Visible effects and abnormalities, e.g., chlorosis and necrosis, were noted and photographed.

The residual effect assay measured inhibition of seed germination in a soil matrix and inhibition of shoot length in the resulting seedlings. The shoot length measurements were made 4 weeks after seedling.

Soil Matrix Properties:

The early plant growth assay and residual effects assay used 2-mm sieved sandy loam soil (11% clay, 19% silt, and 70% sand). The soil pH in water was 7.0, and the soluble salts content, expressed as electrical conductance, was 2.00 mmhos/cm^2.

Growth Conditions:

Plant emergence assays were conducted in the dark. Early plant growth and residual effect assays were conducted with a 16-hr. photoperiod, a temperature of 23±1°C, and a ambient relative humidity of 60%.

Calculations:

The EC_{50} values reported in the attached table were based on nominal concentrations in the test media at the beginning of the bioassay.

The concentrations tested and the corresponding response data (percent inhibition) were averages of two replications per test concentration, with 5 seeds or seedlings per replicate. These data were used to calculate the median effective concentrations, "EC_{50}'s." The 95% confidence limits for the EC_{50} values were also calculated.

Acceptability of Tests:

These laboratory phytotoxicity tests met acceptability criteria provided in the referenced test guidelines: A minimum of 80% of the control seeds germinated, and a minimum of 80% of the control group produced healthy seedlings throughout the test.

Results and Discussion

The inhibition data obtained during the 10-day plant emergence assay are summarized in Tables 1-2. Similarly, the values obtained from the early plant growth assay are listed in Tables 3-4. The residual effects data obtained with soybean are summarized in Table 5. All the raw data generated from these studies are archived in the Environmental Laboratory test facility, Bldg. 2-3E, St. Paul.

1. Plant Emergence Assay (Tables 1 and 2).

The 10-day plant emergence assay showed that exposure to [redacted] at its typical use strength (6%, V/V), caused nearly complete inhibition of plant root elongation in all six species tested. Two species, oat and ryegrass, showed complete inhibition of germination at this concentration. These same species were the only two showing inhibition of germination at concentrations below 3% V/V. Measurable inhibition of root elongation was common to all six plant species tested and occurred at all test concentrations. The concentration one order of magnitude below the usage concentration, 0.6%, only inhibited seed germination in ryegrass (by 20%) but reduced root elongation in all test species by 50% or more.

2. Early Plant Growth Assay (Tables 3 and 4).

The 14-day early plant growth assay showed that [redacted] at its typical usage strength (6%, V/V), affected the early stages of plant growth and development. The two plant growth effects measured, shoot length and shoot dry weight were in good agreement. Reduction in plant growth, as determined with these growth measurements, was notably higher for the same concentration of chemical applied to the soil matrix (root exposure) as opposed to application to leaves (foliar exposure). However, twice as much chemical was applied to the soil, and in comparisons corrected for the total amount of [redacted] added, the differences between the effects of soil and foliar application are small.

Adverse effects on the above ground portion of the plants due to exposure through the soil is indicative of transport to the above ground portion of the plant. With the exception of corn, effects due to this apparent chemical uptake and vascular translocation were equally notable in both groups of plants, the monocotyledons and the dicotyledons. The early plant growth assay showed that a test concentration one order of magnitude below the usage concentration, 0.6%, inhibited shoot length by less than 20% and shoot weight by less than 35%.

Morphorological abnormalities, e.g., chlorosis and necrosis, were noted (relative to the control group) during preliminary examinations of the shoot growth and the root system of seedlings. These observations were most notable for the plants exposed to the highest test concentration (see Figures 1-6).

3. Residual Effect Assay (Table 5 and Figures 7-10).

In a separate preemergence experiment, the residual effect of [ ] to soybean growth, at its typical usage strength (6%, V/V), was clearly identified. Planting soybean seeds immediately or 1 week after [ ] application resulted in complete inhibition of shoot growth. Delaying planting for two weeks combined with 2-inch water washings one week following planting, resulted in a significant reduction in inhibition. In these 2-week delayed plantings, shoot length increased to approximately 50% of control shoot length. A delay period of four weeks with three weekly 2-inch washings reduced inhibition of early plant growth again. In this planting, treated pots showed only a 16% inhibition compared to controls. Effects on soybean root nodulation were not observed because experiments were terminated prior to nodule formation.

This premergence study showed that [ ] can cause residual effects in soil, but that leaching and/or degradation of the chemical in soil will reduce these residual effects. This residual effect study did not differentiate between leaching or degradation as the cause of the soil recovery.

References

1. Organization for Economic Cooperation and Development (OECD). 1984. Terrestrial Plants Growth Test #208, Adopted April, 1984. OECD, Paris, France.

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3. U.S. Environmental Protection Agency (U.S.EPA). 1975. Test Methods for Assessing the Effects of Chemicals on Plants. Office of Toxic Substances. U.S.EPA, Washington, D.C., EPA 560/5-75-008.

4. Health and Safety Commission. 1982. Approved Code of Practice, Methods for the Determination of Ecotoxicity - Test No. 9. H. M. Stationary Office, London, England.

TABLE 1. Effects of [redacted] Type V on Six Plant Species
10-Day Plant Emergence Assay
Seed Germination, Percent Inhibition[1]

Test Concentration (% by Vol.)[2]	Plant Species					
	Monocotyledons			Dicotyledons		
	Corn	Oat	Ryegrass	Soybean	Cucumber	Tomato
0.06	0	0	10	0	0	0
0.6	0	0	20	0	0	0
1.5	0	10	40	0	0	0
3.0	0	60	80	25	0	40
6.0	10	100	100	55	10	75
EC_{50}, % by vol. (95% C.L.)	>6	2.6 (2.4-2.8)	1.8 (1.6-2.0)	5.2 (4.7-6.1)	>6	4.2 (3.5-5.0)

(1) Relative to the control group.

(2) Data are averages of two replications per test concentration, using five seeds per replicate.

TABLE 2. Effects of [ ] Type V on Six Plant Species
10-Day Plant Emergence Assay
Root Elongation, Percent Reduction(1)

Test Concentration (% by Vol.)(2)	Plant Species					
	Monocotyledons			Dicotyledons		
	Corn	Oat	Ryegrass	Soybean	Cucumber	Tomato
0.06	29	28	20	17	33	18
0.6	45	78	57	55	61	75
1.5	63	90	93	88	82	83
3.0	89	97	100	96	91	96
6.0	96	100	100	100	100	100
EC_{50}, % by vol. (95% C.L.)	0.8 (0.6-1.0)	0.16 (0.11-0.21)	0.26 (.13-.50)	0.31 (0.20-0.50)	0.20 (0.12-0.30)	0.25 (0.19-0.33)

(1) Relative to the control group.

(2) Data are averages of two replications per test concentration, using five seeds per replicate.

TABLE 3. Effects of [ ] Type V on Six Plant Species
14-Day Early Plant Growth Assay
Shoot Length, Percent Inhibition(1)

Test Concentration (% by Vol.)(2)	Plant Species											
	Monocotyledons						Dicotyledons					
	Corn		Oat		Ryegrass		Soybean		Cucumber		Tomato	
	RE(3)	FE(3)	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
0.6	1	0	0	0	0	0	0	0	0	0	16	6
1.5	3	0	0	0	0	11	9	20	8	10	29	6
3.0	5	0	20	0	0	15	31	18	33	20	45	16
6.0	29	7	100	9	33	19	100	31	100	42	82	30
EC_{50}, % by vol. (95% C.L.)	>6	>6	3.5 (3.4-3.6)	>6	>6	>6	3.2 (2.4-4.3)	>6	3.2 (2.5-4.1)	>6	3.2 (2.0-5.0)	>6

(1) Relative to the control group.

(2) Data are averages of two replications per test concentration, using five 2-week old seedlings per replicate.

(3) Method of chemical application:
(RE) Root Exposure, applied to soil with water.
(FE) Foliar Exposure, foliar spray.

TABLE 4. Effects of [ ] Type V on Six Plant Species
14-Day Early Plant Growth Assay
Shoot Weight(1), Percent Inhibition(2)

Test Concentration (% by Vol.)(3)	Plant Species: Monocotyledons						Dicotyledons					
	Corn		Oat		Ryegrass		Soybean		Cucumber		Tomato	
	RE(4)	FE(4)	RE	FE	RE	FE	RE	FE	RE	FE	RE	FE
0.6	3	12	32	0	19	0	0	4	20	0	27	16
1.5	15	12	25	0	15	0	35	40	33	0	53	13
3.0	26	16	41	0	19	0	39	50	55	0	78	29
6.0	39	15	100	0	74	19	100	62	100	57	100	56
EC_{50}, % by vol. (95% C.L.)	>6	>6	4.2 (-)	>6	4.0 (3.1 -5.3)	>6	2.4 (1.5- 4.0)	3.0 (2.1- 4.1)	2.2 (2.0- 4.3)	5.8 (5.3- 6.1)	1.3 (1.1- 1.5)	5.2 (4.3- 6.9)

(1) Based on shoot dry weight (oven-dried at 70±2°C).

(2) Relative to the control group.

(3) Data are averages of two replications per test concentration, using five 2-week old seedlings per replicate.

(4) Method of chemical application:
(RE) Root Exposure, applied to soil with water.
(FE) Foliar Exposure, foliar spray.

TABLE 5. Residual Effects of [ ] Type V (6% by Vol.) to Soybean 14-Day Early Plant Growth Assay

Test Set(1)	Delayed Planting(2)	Seed Germination % Inhibition(3)	Shoot Length % Inhibition(3)
A	4 Weeks	7	16
B	2 Weeks	30	54
C	1 Week	70	100
D	0 (seed planting immediately followed chemical application)	96	100

(1) Data are averages of three replications per test set, seed germination measurements used 7-8 seeds per replicate. Shoot length inhibition measurements were done after thinning to 5 soybean seedlings per replicate. Some pots contained less than 5 seedlings due to low germination.

(2) Weekly 2 inch water washings were provided starting one week after treating and ending 1 week prior to seed planting.

(3) Relative to the control group.